

## TITLE OF THE INVENTION

## HERMETIC COMPRESSOR

## 5 CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Korean Patent Application No. 2003-75214, filed October 27, 2003 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

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## BACKGROUND OF THE INVENTION

## Field of the Invention

The present invention relates, in general, to hermetic compressors and, more particularly, to a hermetic compressor which uses a bearing to execute a smooth operation between moving parts of the hermetic compressor.

## Description of the Related Art

Generally, compressors are machines that compress a substance, such as a gas refrigerant, to reduce a volume and thus increase a pressure of the substance or change a phase of the substance. As an example of the compressors, hermetic compressors are typically used in refrigeration systems to compress a gas refrigerant within a hermetic compression chamber while converting a rotating motion into a rectilinear motion, prior to discharging the compressed refrigerant to a condenser.

25 Conventional hermetic compressors having the above-mentioned use have a hermetic casing. The hermetic casing is fabricated with upper and lower casing parts

assembled into a single body, and has a compression unit and a drive unit therein. The compression unit draws and then compresses a gas refrigerant, while the drive unit generates a drive power to operate the compression unit.

In the conventional hermetic compressors, the compression unit has a cylinder  
5 block which is integrated with a frame and defines a compression chamber therein, and a cylinder head which is mounted to the cylinder block. The cylinder head has both a suction chamber to draw the gas refrigerant into the compression chamber and an exhaust chamber to release the compressed refrigerant from the compression chamber to an outside of the hermetic casing. The conventional hermetic compressors further  
10 include a piston which is received in the compression chamber to execute a rectilinear reciprocating motion in the compression chamber.

The drive unit is placed under the compression unit in the hermetic casing, and includes a stator along which an electromagnetic field is generated when electricity is applied to the stator. The drive unit further includes a rotor which rotates by the  
15 electromagnetic field generated along the stator, and a rotating shaft which axially penetrates a center of the rotor so as to rotate along with the rotor.

The rotating shaft is set in a bore of the frame, with an eccentric part provided at an upper end of the rotating shaft. The frame has a bearing seat at an upper end of the bore, and a thrust bearing is seated in the bearing seat of the frame, thus supporting the  
20 eccentric part of the rotating shaft.

The above-mentioned conventional hermetic compressor is problematic as follows. When an impact is applied to the rotating shaft during a refrigerant compressing operation of the piston in the compression chamber, the impact is concentrated on a ball of the thrust bearing. The ball of the thrust bearing is thus overloaded, so that the thrust  
25 bearing cannot smoothly rotate and thereby cannot effectively support a rotation of the

eccentric part of the rotating shaft.

In a detailed description, because the load imposed on the thrust bearing is unevenly distributed on all balls of the thrust bearing, friction between the balls and a lower race of the thrust bearing increases. The conventional hermetic compressor thus  
5 generates noise, and has reduced operational efficiency.

## SUMMARY OF THE INVENTION

Accordingly, it is an aspect of the present invention to provide a hermetic  
10 compressor, which has an improved bearing seat structure to seat a thrust bearing therein while allowing the thrust bearing to smoothly rotate, regardless of a load imposed on the thrust bearing during an operation of the hermetic compressor, thus effectively supporting a rotation of a rotating shaft of a drive unit.

Additional aspects and/or advantages of the invention will be set forth in part in  
15 the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

The above and/or other aspects are achieved by providing a hermetic compressor, including: a hollow frame; a rotating shaft placed in a hollowed part of the frame so as to rotate relative to the frame; an eccentric part provided on the rotating shaft  
20 so as to eccentrically rotate; a piston to rectilinearly move, in response to an eccentric rotation of the eccentric part; a cylinder provided on an upper end of the hollow frame so as to allow the piston to compress a fluid in the cylinder; a bearing seat provided on an upper end of the hollowed part of the frame; a thrust bearing seated in the bearing seat so as to support the eccentric part; an oil path provided in the rotating shaft so as to  
25 guide oil upward; an oil discharge hole to communicate with the oil path, thus discharging

the oil to an outer surface of the rotating shaft; and an oil slot provided in the bearing seat, thus allowing the oil discharged from the oil discharge hole to flow through the oil slot.

5 The oil slot may extend on a bottom surface of the bearing seat in a radial direction.

The bearing seat may include an inclined surface which is formed around the bottom surface of the bearing seat while being inclined upward and outward, with a diameter of the inclined surface increasing in an outward direction from an inside edge to an outside edge of the inclined surface.

10 The oil slot may extend to the inclined surface of the bearing seat and to an edge of the hollowed part of the frame, thus having extension slot parts with predetermined lengths.

The oil slot may comprise a plurality of oil slots which are formed on the bearing seat while being spaced apart from each other at predetermined angular intervals.

15 The oil slot may be widened at an oil inlet of the oil slot.

The oil slot may be shaped in a helical manner, with a width of the oil slot reducing in a direction from an oil inlet to an oil outlet of the oil slot.

## BRIEF DESCRIPTION OF THE DRAWINGS

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These and other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the preferred embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a side sectional view showing a construction of a hermetic compressor,  
25 according to the present invention;

FIG. 2 is an exploded perspective view of a frame of the hermetic compressor, according to a first embodiment of the present invention;

FIG. 3 is a plan view showing a shape of an oil slot of the frame of FIG. 2; and

FIGS. 4 and 5 are plan views respectively showing shapes of oil slots, according to second and third embodiments of the present invention.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the present preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

FIG. 1 is a side sectional view showing a construction of a hermetic compressor, according to the present invention.

As shown in FIG. 1, the hermetic compressor according to the present invention includes a hermetic casing 10 which is fabricated with upper and lower casing parts 11 and 12 assembled into a hermetic single body. The hermetic compressor further includes a compression unit 20 to draw and compress a gas refrigerant, and a drive unit 30 to drive the compression unit 20.

In the hermetic compressor, the compression unit 20 has a cylinder block 22 which is integrated with a frame 21 and defines a compression chamber 22a therein, and a cylinder head 23 which is mounted to the cylinder block 22. The cylinder head 23 has both a suction chamber 23a to draw the gas refrigerant into the compression chamber 22a and an exhaust chamber 23b to release the compressed refrigerant from the compression chamber 22a to an outside of the hermetic casing 10. The hermetic

compressor further includes a piston 24 which is received in the compression chamber 22a to execute a rectilinear reciprocating motion in the compression chamber 22a.

The hermetic compressor further includes a valve plate 25. The valve plate 25 is interposed between the cylinder block 22 and the cylinder head 23 to control flows of the refrigerant drawn into and discharged from the compression chamber 22a.

The drive unit 30 is placed under the compression unit 20 in the hermetic casing 10, and includes a stator 31 along which an electromagnetic field is generated when electricity is applied to the stator 31. The drive unit 30 further includes a rotor 32 which rotates by the electromagnetic field generated along the stator 31, and a rotating shaft 33 which axially penetrates a center of the rotor 32 so as to rotate along with the rotor 32.

The rotating shaft 33 has an eccentric part 34 which is provided at an upper end of the rotating shaft 33 to eccentrically rotate. The eccentric part 34 of the rotating shaft 33 includes a balance weight 34a to allow the rotating shaft 33 to rotate while keeping balance thereof regardless of the eccentric part 34, and an eccentric shaft 34b which extends upward from the balance weight 34a to a predetermined length and eccentrically rotates during a rotation of the rotating shaft 33. The piston 24 is connected to the eccentric shaft 34b of the eccentric part 34 through a connecting rod 35, so that the eccentric rotation of the eccentric shaft 34b is converted into a rectilinear reciprocation of the piston 24 by the connecting rod 35. Therefore, when the eccentric part 34 rotates along with the rotating shaft 33, the piston 24 rectilinearly reciprocates in the compression chamber 22a. The rotating shaft 33 is set in a bore 21a of the frame 21. The frame 21 has an annular bearing seat 40 around an upper end of the bore 21a, and a thrust bearing 50 is seated in the bearing seat 40 of the frame 21, thus supporting the eccentric part 34 of the rotating shaft 33. The thrust bearing 50 includes a plurality of balls 51 which are supported between upper and lower races 52 and 53.

The rotating shaft 33 has an oil path 33a. The oil path 33a extends through the rotating shaft 33 from a lower end of the rotating shaft 33 to the eccentric shaft 34b, thus drawing and guiding oil L to the eccentric shaft 34b. The rotating shaft 33 further includes a spiral oil groove 33b. The spiral oil groove 33b is formed around an outer surface of the rotating shaft 33 from a position where the rotating shaft 33 is in sliding contact with the frame 21. The spiral oil groove 33b communicates with the oil path 33a via both an oil suction hole 33d and an oil discharge hole 33c which are respectively provided at upper and lower ends of the spiral oil groove 33b.

Therefore, the oil L is drawn from a bottom of the hermetic casing 10 into the oil path 33a of the rotating shaft 33, and flows upward to a predetermined height along the oil path 33a, prior to being discharged from the oil path 33a to the spiral oil groove 33b through the oil discharge hole 33c. The discharged oil, thereafter, flows along the spiral oil groove 33b, thus forming lubrication layers in the junction gaps between the rotating shaft 33 and the frame 21 and between the rotating shaft 33 and the thrust bearing 50.

The hermetic compressor of the present invention further includes a plurality of oil slots 43 which are formed on the bearing seat 40 while being spaced apart from each other at regular angular intervals, as shown in FIG. 2.

The bearing seat 40 includes an annular bottom surface 41, with an annular inclined surface 42 which is formed around the annular bottom surface 41 while being inclined upward and outward. Thus, a diameter of the annular inclined surface 42 gradually increases in an outward direction from an inside edge to an outside edge of the annular inclined surface 42. Each of the oil slots 43 extends from a predetermined portion of the annular inclined surface 42 to an edge of the upper end of the bore 21a, so that each of the oil slots 43 has an upper extension slot part 45 with an oil outlet and a lower extension slot part 44 with an oil inlet.

Due to the plurality of oil slots 43, the oil L flows under a lower surface of the thrust bearing 50, thus the oil L hydraulically supports the lower race 53 of the thrust bearing 50.

In the present invention, shapes of the oil slots 43 may be alternately designed  
5 without affecting the functioning of the invention, as shown in FIGS. 3, 4 and 5.

In a first embodiment of the present invention, the oil slots 43 are formed on the bearing seat 40 such that each of the oil slots 43 extends in a radial direction while having a constant width, as shown in FIG. 3. In a second embodiment of the present invention, the oil slots 43 are formed to respectively have widened oil inlets 43a, as  
10 shown in FIG. 4. In a third embodiment of the present invention, the oil slots 43 are shaped in a helical manner, with a width of each of the oil slots 43 gradually reducing in a direction from the oil inlet 43a to the oil outlet 43b, as shown in FIG. 5. In the second and third embodiments of the present invention, the oil L is smoothly introduced into the oil slots 43, during an operation of the hermetic compressor.

15 The operation and effect of the hermetic compressor according to the present invention will be described herein below.

When the hermetic compressor is powered on, an electromagnetic field is generated along the stator 31, and the rotor 32 rotates by the electromagnetic field generated along the stator 31. In the above state, the rotating shaft 33 that axially  
20 penetrates the center of the rotor 32 rotates along with the rotor 32. Because the piston 24 is connected to the eccentric shaft 34b of the eccentric part 34 through the connecting rod 35, the piston 24 rectilinearly reciprocates within the compression chamber 22a by the rotation of the rotating shaft 33, thus drawing the refrigerant into the compression chamber 22a and compressing the refrigerant, prior to discharging the refrigerant from  
25 the compression chamber 22a.



During the rotation of the rotating shaft 33, the oil L flows upward along the oil path 33a of the rotating shaft 33. In the above state, a part of the oil L is discharged from the oil path 33a to the spiral oil groove 33b through the oil discharge hole 33c. The discharged oil, thereafter, flows along the spiral oil groove 33b while lubricating the rotating shaft 33 and the thrust bearing 50. The oil L further flows through the plurality of oil slots 43 which are placed under the lower surface of the thrust bearing 50, thus the oil L hydraulically supports the lower race 53 of the thrust bearing 50 upward.

Therefore, even when an impact is applied to the rotating shaft 33 during a refrigerant compressing operation of the piston 24 in the compression chamber 22a, the impact load imposed on the thrust bearing 50 is evenly distributed along a junction between the lower race 53 and the all balls 51 of the thrust bearing 50, because the oil L hydraulically supports the lower race 53 of the thrust bearing 50 upward. The thrust bearing 50 thus smoothly rotates and thereby effectively supports the rotation of the eccentric part 34 of the rotating shaft 33.

The hermetic compressor of the present invention thus reduces vibration of the balls 51 and the lower race 53 of the thrust bearing 50, and attenuates noise caused by the vibration. The hermetic compressor further has improved operational efficiency.

As apparent from the above description, the present invention provides a hermetic compressor, in which a plurality of oil slots are formed on a bearing seat that seats a thrust bearing therein. During an operation of the hermetic compressor, oil flows through the plurality of oil slots while hydraulically supporting a lower surface of the thrust bearing upward.

Therefore, even when an impact is applied from a piston to a rotating shaft during a refrigerant compressing operation of the piston in a compression chamber, the impact load imposed on the thrust bearing is evenly distributed along a junction between a lower

race and all balls of the thrust bearing, because the oil hydraulically supports the lower race of the thrust bearing upward. The thrust bearing thus smoothly rotates and effectively supports the rotation of an eccentric part of the rotating shaft. Therefore, the hermetic compressor of the present invention reduces vibration of the balls and the lower  
5 race of the thrust bearing, and attenuates noise caused by the vibration. The hermetic compressor further has improved operational efficiency.

Although a few preferred embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of  
10 the invention, the scope of which is defined in the claims and their equivalents.